



# Charlson-Deyo Comorbidity Index and Overall Survival Following Total Glossectomy for Oral Tongue Squamous Carcinoma

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## Abstract

**Objective:** The Charlson-Deyo Comorbidity Index (CCI) is a validated tool for quantifying comorbid burden. This study evaluates the association between CCI and overall survival (OS) following total glossectomy for oral tongue squamous cell carcinoma (OTSCC).

**Methods:** A retrospective review of the 2004–2016 National Cancer Database (NCDB) identified adult patients with pT1–4 N0–3 M0 OTSCC who underwent total glossectomy. Kaplan-Meier analysis and Cox proportional hazards modeling were used to examine the impact of increasing CCI on OS.

**Results:** Of 3,443 eligible patients, 2,724 (79%) were CCI=0, 571 (16%) were CCI=1, and 170 (5%) were CCI=2+. Higher CCI was associated with older age and advanced T-stage ( $p<0.01$ ). No differences were seen in sex, race, or margin status. Five-year OS for CCI=0, 1, and 2+ was 51.6%, 44.6%, and 37.8%, respectively ( $p<0.001$ ). On multivariable analysis, CCI=2+ was independently associated with worse OS (HR 1.40, 95% CI 1.05–1.86,  $p=0.020$ ).

**Conclusions:** Among patients undergoing total glossectomy for OTSCC, high comorbidity burden (CCI≥2) was associated with significantly decreased OS. These findings highlight the importance of comorbidity assessment in preoperative counseling and individualized treatment planning.

## Introduction

- Oral tongue squamous cell carcinoma (OTSCC) is the most common oral cavity cancer, comprising 25–40% of cases. (1,2,3)
- OTSCC is aggressive, with 5-year survival rates as low as 38%. (4,5)
- Incidence has risen globally over the past two decades. (6)
- Treatment of advanced disease often requires total glossectomy, which carries high morbidity (speech, swallowing, and quality of life deficits). (4)
- Prognostic factors usually include TNM staging and histopathologic features (depth of invasion, perineural invasion, extranodal extension). (4)
- Comorbidities are not captured by TNM, but may strongly affect survival and treatment tolerance.
- The Charlson-Deyo Comorbidity Index (CCI) is a validated comorbidity score used in many cancers. (7)
- This study investigates the role of CCI in predicting 5-year OS in OTSCC patients undergoing total glossectomy.

## Study Design

### Patient Database

- Retrospective analysis of the National Cancer Database (NCDB). A total of 3,443 adult patients with pT1–4 N0–3 M0 oral tongue squamous cell carcinoma (OTSCC) who underwent total glossectomy were identified from 2004–2016.
- The NCDB, jointly sponsored by the ACS and CoC, captures >70% of newly diagnosed cancers from >1,500 accredited hospitals across the U.S.

### Statistical Methods

- Kaplan-Meier survival and log-rank tests evaluated 5-year overall survival by Charlson-Deyo Comorbidity Index (CCI).
- Multivariable Cox regression identified independent predictors of OS, adjusting for demographic, pathologic, and treatment variables.
- Analyses were conducted using SPSS version 29.

## Discussion

- Prior studies have shown that Charlson-Deyo Comorbidity Index (CCI) predicts survival across cancers, but its role in OTSCC has been less defined. (7,8,9) In this national cohort of patients undergoing total glossectomy, higher CCI scores were independently associated with worse 5-year OS, even after adjusting for tumor and treatment factors.
- These findings suggest that comorbidity burden contributes to outcomes beyond tumor stage, likely reflecting reduced treatment tolerance and recovery in patients with multiple conditions. Given the morbidity of total glossectomy, comorbidity assessment should complement traditional staging, and future work may refine prognostication using frailty indices or composite risk models. (10)

## Conclusion

- In a national cohort of OTSCC patients undergoing total glossectomy, higher Charlson-Deyo Comorbidity Index (CCI) scores were independently associated with worse overall survival. These findings indicate that comorbidity burden has important prognostic value beyond tumor staging. Future work should integrate comorbidity and frailty measures to refine surgical risk assessment and guide individualized treatment planning.

## Results

	CCI=0	CCI=1	CCI=2+	Total	P value
No.	2,724 (78.6)	571 (16.5)	170 (4.91)	3,465	-
Age					<0.001
Under 65	1752 (68.0)	350 (54.6)	98 (44.3)	2202 (64.0)	
65 or older	827 (32.0)	291 (45.4)	123 (55.7)	1241 (36.0)	
Sex					0.283
Male	1582 (61.3%)	385 (60.1%)	146 (66.1)	2113 (61.4)	
Female	999 (38.7%)	256 (39.9%)	75 (33.9)	1330 (38.6)	
Race					0.795
White	2232 (86.5%)	566 (88.3%)	193 (87.3)	2991 (86.9)	
Black	190 (7.4%)	41 (6.4%)	16 (7.2)	247 (7.2)	
Asian	83 (3.2%)	18 (2.8%)	4 (1.8)	105 (3.0)	
Other	76 (2.9%)	16 (2.5%)	8 (3.6)	100 (2.9)	
Primary site					0.292
Anterior Tongue (Dorsal, Ventral, Anterior 2/3)	981 (38.0%)	258 (40.2%)	93 (42.1)	1332 (38.7)	
Border of Tongue	407 (15.8%)	99 (15.4%)	32 (14.5)	538 (15.6)	
Lingual Tonsil	77 (3.0%)	9 (1.4%)	2 (0.9)	88 (2.6)	
Overlapping Lesion of Tongue	220 (8.5%)	60 (9.4%)	19 (8.6)	299 (8.7)	
Tongue, NOS	896 (34.7%)	215 (33.5%)	75 (33.9)	1186 (34.4)	
pT classification					
1	605 (23.4%)	130 (20.3%)	52 (23.5)	787 (22.9)	
2	641 (24.8%)	157 (24.5%)	77 (34.8)	875 (25.4)	0.006
3	385 (14.9%)	113 (17.6%)	34 (15.4)	532 (15.5)	
4	546 (21.2%)	143 (22.3%)	39 (17.6)	728 (21.1)	
X	404 (15.7%)	98 (15.3%)	19 (8.6)	521 (15.1)	
pN classification					0.026
0	910 (35.3%)	215 (33.5%)	100 (45.2)	1225 (35.6)	
1	327 (12.7%)	90 (14.0%)	23 (10.4)	440 (12.8)	
2	798 (30.9%)	196 (30.6%)	69 (31.2)	1063 (30.9)	
3	15 (0.6%)	8 (1.2%)	0 (0.0)	23 (0.7)	
X	531 (20.6%)	132 (20.6%)	29 (13.1)	692 (20.1)	
Surgical margins					0.292
Negative	2197 (87.2)	540 (85.2)	184 (84.8)	2921 (86.7)	
Positive	323 (12.8%)	94 (14.8%)	33 (15.2)	450 (13.3)	
Systemic Therapy					<0.001
No	1796 (69.6)	445 (69.4)	182 (82.4)	2423 (70.4)	
Yes	785 (30.4)	196 (30.6)	39 (17.6)	1020 (29.6)	
Radiation Therapy					
No	1128 (43.7)	301 (47.0)	123 (55.7)	1552 (45.1)	0.002
Yes	1453 (56.3)	340 (53.0)	98 (44.3)	1891 (54.9)	<0.001
90 Day Mortality					
Patient Alive After 90 Days	2202 (96.5)	534 (94.2)	160 (91.4)	2896 (95.8)	
Patient died 90 or fewer days after surgery performed	80 (3.5)	33 (5.8)	15 (8.6)	128 (4.2)	
Readmission Within 30 Days					0.859
No surgical procedure of the primary site was performed/patient not readmitted	2300 (89.3)	569 (88.8)	199 (90.0)	3068 (89.2)	
Planned/unplanned readmission within 30 days of discharge	276 (10.7)	72 (11.2)	22 (10.0)	370 (10.8)	

**Table 1.** Patient demographics and clinicopathologic features of 3,443 pT1–4 N0–3 M0 Tumors Undergoing Total Glossectomy, by CCI, n (%)

	Univariable		Multivariable	
	HR (95% CI)	P value	aHR (95% CI)	P value
Charlson-Deyo comorbidity score				
0	Ref			
1	1.233 (1.034-1.471)	0.020	1.032 (0.863-1.235)	0.729
≥ 2	1.569 (1.189-2.071)	0.001	1.401 (1.054-1.861)	0.020
Age				
<65 years old	Ref			
≥65 years old	1.652 (1.428-1.912)	<0.001	1.803 (1.548-2.099)	<0.001
Sex				
Male	Ref			
Female	0.766 (0.766-0.891)	<0.001	0.841 (0.720-0.982)	0.028
Race				
White	Ref			
Black	1.291 (0.985-1.692)	0.065	0.877 (0.562-1.368)	0.562
Asian	0.877 (0.562-1.368)	0.986	1.004 (0.668-1.508)	0.986
Primary site				
Anterior Tongue (Dorsal, Ventral, Anterior 2/3)	Ref			
Border of Tongue	0.760 (0.598-0.965)	0.025	0.804 (0.632-1.024)	0.077
Lingual Tonsil	0.287 (0.142-0.580)	<0.001	0.263 (0.128-0.539)	<0.001
Overlapping Lesion of Tongue	1.635 (1.280-2.089)	<0.001	1.288 (1.006-1.649)	0.045
Tongue, NOS	1.082 (0.920-1.273)	0.343	1.017 (0.863-1.199)	0.842
pT classification				
1	Ref			
2	2.652 (2.015-3.489)	<0.001	2.092 (1.574-2.780)	<0.001
3	4.032 (3.035-5.356)	<0.001	2.737 (2.027-3.697)	<0.001
4	5.742 (4.397-7.500)	<0.001	3.477 (2.588-4.671)	<0.001
X	2.942 (2.199-3.938)	<0.001	2.743 (1.747-4.306)	<0.001
pN classification				
0	Ref			
1	1.910 (1.477-2.470)	<0.001	1.808 (1.391-2.349)	<0.001
2	3.444 (2.847-4.166)	<0.001	2.734 (2.219-3.369)	<0.001
3	7.266 (4.031-13.099)	<0.001	7.604 (4.095-14.123)	<0.001
X	1.743 (1.386-2.191)	<0.001	1.406 (0.912-2.166)	0.123
Surgical margins				
Negative	Ref			
Positive	2.160 (1.806-2.582)	<0.001	1.695 (1.408-2.039)	<0.001
Systemic Therapy				
No	Ref			
Yes	1.418 (1.225-1.641)	<0.001	0.807 (0.686-0.950)	0.010
Radiation Therapy				
No	Ref			
Yes	1.391 (1.200-1.613)	<0.001		

**Table 2:** Multivariable Cox Proportional Hazard Regression Models of 5-Year OS Among